MDT 60

VIDEO DISPLAY TERMINAL

USER'S MANUAL

MORROW

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Morrow
600 McCormick St.
San Leandro, CA 94577

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FCC NOTICE

This equipment generates and uses radio frequency energy and if
not installed and used properly, that is, in strict accordance
with the manufacturer's instructions, may cause interference to
radio and television reception. It has been type tested and
found to comply with the limits for a Class A computing device in
accordance with the specifications in Subpart J of Part 15 of FCC
rules, which are designed to provide reasonable protection
against such interference in a residential installation. How-
ever, there is no guarantee that interference will not occur in a
particular installation. If this equipment does cause interfer-
ence to radio or television reception, which can be determined by
turning the equipment off and on, the user is encouraged to try
to correct the interference by one or more of the following
measures:

- Reorient the receiving antenna

- Relocate the equipment with respect to the receiver

- Move the equipment away from the receiver

- Plug the equipment into a different outlet so that the
  equipment and receiver are on different branch circuits

If necessary, the user should consult the dealer or an exper-
ienced radio/television technician for additional suggestions.
The user may find the following booklet prepared by the Federal
Communication helpful:

 "How to Identify and Resolve Radio TV Interference Problems"

This booklet is available from the U.S. Government Printing
Office, Washington, DC 20402. Stock No. 004-000-00345-4.

UNDERWRITERS LABORATORY NOTICE

Before connecting your terminal, read the following precautions carefully. Your terminal is designed to be switched for operation on different voltages as follows:

<div align="center">

115V   60 Hz
230V   50 Hz

</div>

This terminal is equipped with a three-wire grounding type plug having a third (grounding) pin. This plug will fit only into a grounded outlet. This is a safety feature. If you are unable to insert the plug into the outlet, contact your electrician to replace your obsolete outlet. DO NOT DEFEAT THE SAFETY PURPOSE OF THE GROUNDING PLUG.

DO NOT PLUG THE POWER PLUG INTO THE OUTLET WITHOUT FIRST CHECKING THAT THE VOLTAGE SWITCH IS IN THE PROPER POSITION FOR THE LOCAL POWER SUPPLY, AND THAT THE PROPER POWER SUPPLY CORD IS BEING USED. SEE FIG. 2-1.

Your terminal will not operate if the switch is in the "220 Volt" position and you plug it into a "110 Volt" supply. Conversely, plugging it into a "220 Volt" supply when the voltage selector switch is in the "110 Volt" position may cause serious damage to the terminal.
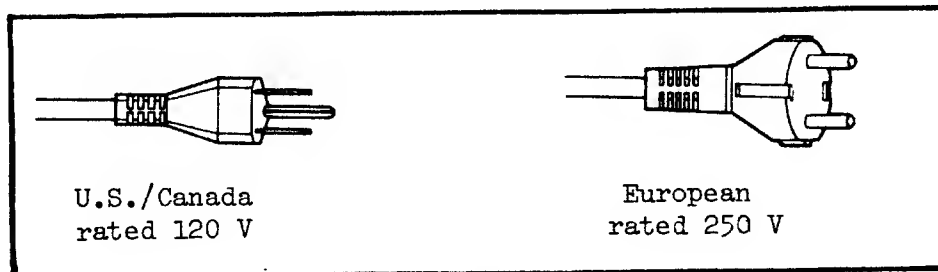
Note that using an incorrect power source damaging to the terminal will void the manufacturer's warranty.

Voltage Selection - Determine the voltage available in your location, then make certain the Voltage Selector Switch on the back of your terminal is set accordingly. If in doubt, contact your local power company.

The Voltage Selector Switch is located on the back of the terminal, and is recessed to prevent accidental switching.

Power Cord Plug - The power supply cord that comes with your terminal is provided with a three-prong grounding type plug (NEMA type 5-15) which is suitable for use with a 110 Volt AC source as found in the United States and Canada.

In European countries where the local power supply is 220 Volts AC, a suitable adapter must be purchased which will allow you to convert the flat-blade plug to the European style round pin plug.

U.S./Canada
rated 120 V

European
rated 250 V

MDT 60 USER'S MANUAL

TABLE OF CONTENTS

4. CARE OF THE MDT 60

5. TROUBLESHOOTING THE MDT 60

LIST OF FIGURES

LIST OF TABLES

SECTION 1: GENERAL DESCRIPTION

INTRODUCTION

This section describes the specifications of the MDT 60 along with its functional capabilities. These specifications are also listed in Table 1-2.

PURPOSE AND USE

There are numerous applications of the MDT 60 all involving the transfer of data to and from your Morrow Designs Computer. Data transfer in some applications may be almost exclusively unidirectional, such as from the unit to the computer. A more frequent application is one in which you communicate with your computer, and the computer responds in accordance with its stored program for word processing or other application programs.

The MDT 60 has the following general features (all included to enhance the level of performance of your system):

- Twelve inch (30.5 cm) diagonal non-glare display

- Full 128 ASCII character set, in an 80 column by 24-row format, plus 64 special graphics characters and 45 special characters for foreign character sets

- Three visual attributes - dim, reverse video and underline

- Detachable 91-key keyboard with a typewriter style layout

- Fourteen key numeric keypad for numeric entry or special applications functions

- 16 function keys

- RS-232C serial asynchronous interface

- Four selectable transmission rates - 300, 1200, 9600, 19200 baud

PHYSICAL DESCRIPTION

The MDT 60 is a two-piece modular design that includes a monitor assembly and a keyboard assembly. The monitor assembly contains the main logic board, the display driver board with associated cathode ray tube (CRT), and the regulated power supply.
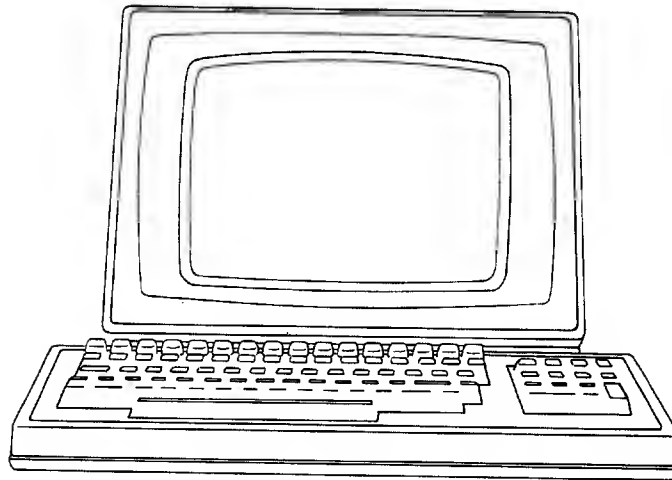
Figure 1-1: MDT 60 Front View

At the back of the housing, you will find the interface connector, keyboard connector, contrast control knob, 5 amp slow blow fuse and power cord.   The keyboard assembly contains the 91-key keyboard and associated logic. A six-foot coiled cord connects the keyboard to the monitor assembly.   Both assemblies are packaged in lightweight, compact housings that provide flexibility and convenience in operation.

OPERATIONAL DESCRIPTION

The MDT 60 is an interactive device which is used to communicate with your Morrow Designs computer.   Using a keyboard similar to that of a typewriter, you may enter information which is immediately transmitted to the computer.   Data from the computer is received and displayed at baud rates as high as 19200.

Control Logic

The Control Logic contains the microprocessor and various integrated circuits which control the operation of your MDT 60. These operations include:

- Timing and control

- Data handling and storage

- Interpreting and responding to commands from the keyboard and the computer

- Video control

- I/O interfacing

- Status control

Data sent to the terminal is received by the Control Logic from the Interface Port. The microprocessor decodes the input data and reformats it into data and control instructions for the Video Logic and Control Logic.

Video Logic and Drive

The Video Logic and Drive section provides the circuitry needed to drive the CRT on the display drive board. The main logic board contains 4K bytes of display random access memory (RAM), character generation circuits, and the video logic. The CRT screen can display 24 lines of data containing as many as 80 characters per line. Data from the control logic is written into the display RAM; control instructions from the CRT controller cause the contents of the RAM to be displayed on the monitor screen. Figure 1-2 depicts the character format and associated hex codes used for display in the MDT 60.

00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F

10	11	12	13	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F

20	21	22	23	24	25	26	27	28	29	2A	2B	2C	2D	2E	2F
	!	"	#	$	%	&	'	(	)	*	+	,	-	.	/

30	31	32	33	34	35	36	37	38	39	3A	3B	3C	3D	3E	3F
0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?

40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F
@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O

50	51	52	53	54	55	56	57	58	59	5A	5B	5C	5D	5E	5F
P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_

60	61	62	63	64	65	66	67	68	69	6A	6B	6C	6D	6E	6F
`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o

70	71	72	73	74	75	76	77	78	79	7A	7B	7C	7D	7E	7F
p	q	r	s	t	u	v	w	x	y	z	{			}	~	

80	81	82	83	84	85	86	87	88	89	8A	8B	8C	8D	8E	8F
Ç	ü	é	â	ä	à	å	ç	ê	ë	è	ï	î	ì	Ä	Å

90	91	92	93	94	95	96	97	98	99	9A	9B	9C	9D	9E	9F
É	æ	Æ	ô	ö	ò	û	ù	ÿ	Ö	Ü	¢	£	¥	₧	ƒ

A0	A1	A2	A3	A4	A5	A6	A7	A8	A9	AA	AB	AC	AD	AE	AF
á	í	ó	ú	ñ	Ñ	ª	º	¿		¬	½	¼	¡	«	»

B0	B1	B2	B3	B4	B5	B6	B7	B8	B9	BA	BB	BC	BD	BE	BF

C0	C1	C2	C3	C4	C5	C6	C7	C8	C9	CA	CB	CC	CD	CE	CF
L	⌐	˥	˩	˦	Γ	˥	˩	┼	┆	─	┼	┠	┬	┴	

D0	D1	D2	D3	D4	D5	D6	D7	D8	D9	DA	DB	DC	DD	DE	DF

E0	E1	E2	E3	E4	E5	E6	E7	E8	E9	EA	EB	EC	ED	EE	EF

F0	F1	F2	F3	F4	F5	F6	F7	F8	F9	FA	FB	FC	FD	FE	FF

Figure   1-2: 220 Character ASCII Format, with Hex Codes

Table 1-1: Displayable USASCII Character Set and Control Codes

		CONTROL CHARACTERS		DISPLAYABLE CHARACTERS					
HEX 1ST		0	1	2	3	4	5	6	7
BYTE 2ND	BITS 4321 / BITS 765	000	001	010	011	100	101	110	111
0	0000	NUL	DLE		`	@	P	f	p
1	0001	SOH	DC1	!	1	D	R	t	q
●	1010	STX	DC2	"	2	B	T	b	r
3	0001	ETX	DC3	#	3	C	S	c	s
1	0100	EOT	DC4	$	1	D	f	$	}
1	0101	ENQ	NAK	%	1	E	U	f	¶
1	0110	ACK	SYN	&	6	E	V	f	}
7	0111	BEEP	ETB	)	1	G	W	$	r
8	1000	BS (←)	CAN	(	6	I	X	h	}
1	1001	(SKIP) HT	EM	)	1	I	I	i	r
1	1010	LF (↓)	SUB	*	:	J	Z	i	z
8	1011	VT (↑)	ESC	)	:	I	f	V	r
E	1100	FF (→)	FS	*	<	E	/	I	¦
D	1101	CR	GS	(	=	M	]	m	}
E	1110	SO	(HOME) RS	)	>	N	f	n	~
F	1111	SI	(NEW LINE) US	/	?	O	—	o	DEL

USE CTRL KEY
WITH DISPLAYABLE
CHARACTER KEYS
TO PRODUCE
CONTROL CODES

Displayable USASCII Character Set and Control Codes

Keyboard

The keyboard contains 91 keys from which data entry and control functions are locally initiated. Each keystroke is encoded into a corresponding ASCII character by the control logic, which is immediately transmitted to the computer and then echoed from the computer via the Computer Port.

Computer Port (Serial RS-232C Interface)

Your Morrow Designs computer and the MDT 60 communicate via the Computer Port. Data and control information from the computer is routed through the Computer Port to the Control Logic. The control logic causes data to be displayed on the monitor in the same manner as the keyboard data. The interface logic contains the circuitry appropriate for interfacing via RS-232C signals. The interface logic also contains the baud rate clock which permits the MDT 60 to receive and transmit data at selected baud rates of 300, 1200, 9600 or 19200 baud.

Regulated Power Supply

The MDT 60 power supply is located in the rear of the base. The power supply can accept line voltage inputs of 115 VAC or 230 VAC (switch-selectable).

Table 1-2: MDT 60 Specifications

SPECIFICATION	DESCRIPTION
DISPLAY	
CRT Screen	12-inch (30.5 cm) diagonal, P31 Green Phosphor with etched faceplate.
Vertical Refresh Rate	60 Hz, non-interlaced.
Horizontal Refresh Rate	18.07 KHz
Display Page	1920 characters/page.
Display Format	80 characters x 24 lines.
Character Set	128 ASCII characters. 45 special characters for foreign character sets (U.S., U.K., German, Spanish, French, Italian, Swedish/Finnish, Danish/Norwegian). 64 special graphics characters, 16 of which are line drawing graphics characters.
Character Matrix	8 x 10 dot matrix.
Character Field	9 x 12 dot matrix.
Cursor	9 x 12 dot matrix, selectable block or underline; steady, slow blink, fast blink, or no cursor.
Cursor Controls	Left, Right, Up, Down, Home, Carriage Return/Line Feed, Tab, Read Cursor and Cursor Addressing.
Visual Attributes	Reverse video, underline, reduced intensity (dim), and combinations thereof (non-embedded).
Alphanumeric	26-letter alphabet with upper and lower case, numerics 0 through 9, Return, Shift, Punctuation, Backspace, Tab, and Caps Lock. Most keys are auto repeating (approximately 15 characters per second). Selectable audible keyclick.

Table 1-2 (Continued)
MDT 60 Specifications

SPECIFICATION	DESCRIPTION
KEYBOARD	
Numeric Key Pad	14 keys: 0 through 9, Enter, Comma, Period, and Minus.
EDITING	
Remote Edit Operation	Clear Entire Screen, insert characters, delete characters, insert line, delete line, erase to the end of line, erase to the end of page.
COMMUNICATIONS	
Monitor Mode	Control characters from the computer are displayed on the screen without being acted upon.
Data Rates	300, 1200, 9600 and 19200 baud.
Word Length	8 Data bits.
Parity	Even, odd, or no parity.
Stop Bits	2 stop bits.
Format	RS-232 serial asynchronous communications.
GENERAL	
Operating Environment:	
Temperature	Operating: 10 to 40 degrees C (41 to 104 degrees F).
	Storage: -15 to 65 degrees C (5 to 150 degrees F).
Humidity	10% to 85% without condensation.

Table 1-2 (Continued)
MDT 60 Specifications

SPECIFICATION	DESCRIPTION
Power Requirements:	
Standard	115V + 10%, 60 Hz, 50 watts.
Optional	230V + 10%, 50 Hz, 50 watts.
Dimensions:	
Width (Monitor)	16.5 inches (42.0 cm)
Depth (Monitor)	14.6 inches (37.0 cm)
Height (Monitor)	12.2 inches (31.0 cm)
Depth (Keyboard)	7.5 inches (19.0 cm)
Height (Keyboard)	2.8 inches (7.0 cm)
Weight	24.2 pounds (11.0 kg)

DISPLAY CHARACTER FORMAT

The standard MDT 60 character set contains 128 ASCII characters, 32 of which are control characters (see Figure 1-2 and Table 1-1). It also has 45 special characters for foreign character sets, and 64 special graphics characters, 16 of which are line drawing graphics characters.

MDT 60 WORD STRUCTURE

The MDT 60 transmits serial asynchronous data in 11 bit format in the following sequence: one start bit, seven data bits, one parity bit and two stop bits. The parity bit can be either odd, even, mark or space, and is defined by paddles 3 and 4 of the rear panel DIP switch.

The received data is formatted the same as the transmitted data. The word structure, baud rates, and other communications characteristics are established via the DIP switch on the rear panel. Refer to Section 2 for details.

230 VAC OPERATION

The MDT 60 will operate on either 110 or 220 volts ac, depending upon the rating of the power source and selection of the line voltage switch on the rear panel (see Line Voltage Selection).

SECTION 2: INSTALLATION

INTRODUCTION

This section contains the simple unpacking and installation instructions for the MDT 60.   Once you unpack and inspect your new terminal, you will set the DIP switch on the rear panel to determine terminal configuration (baud rate, parity, character set and function key sequence type).   You will then connect the cable provided to the MDT 60 and your computer, power on your terminal and adjust the intensity of characters displayed on the screen.

UNPACKING AND INITIAL INSPECTION

Each MDT 60 is thoroughly inspected and carefully packaged prior to shipment.   Every precaution is taken to ensure that each unit is complete and ready for installation at the customer's site. However, it is recommended that each unit be inspected upon receipt for transit damage.   Start by examining the exterior of the package for evidence of rough or careless handling.   If shipping damage exists, note the condition on the waybill, notify the carrier, and contact your dealer.

Next, perform a thorough visual inspection of the internal components and subassemblies. As a rule, most transportation companies will not honor claims for damage unless they're filed promptly; therefore, the following steps should be taken:

1. Verify that each item shown on the Sales Order Packing Slip has been included in the shipment.   Contact your dealer immediately in the event of a packing shortage.

2. Verify that the serial number of the unit corresponds to that shown on the invoice.

3. Check the hardware to determine if any assemblies or screws were loosened during shipment.   Tighten as required.

4. Inspect for dust or foreign material which may impair electrical contact when the cable connection is made.

5. Install and test the MDT 60 as soon as possible after delivery.   This is very important since internal damage to the equipment cannot be determined by visual inspection alone.

6. If, in your opinion, the equipment has been damaged - either internally or externally - notify your dealer immediately, and ask him to make an inspection.

SELECTING A WORK STATION

The MDT 60 may be conveniently used in a normal office environment, as no special mounting provisions are required.

The terminal weighs 24.2 pounds (11.0 kg) and measures 16.5 inches (width) by 14.6 inches (depth) by 12.2 inches (height). We recommend that the environment be weather protected, with an ambient temperature range of 41 to 104 degrees F (10 to 40 degrees C), and a relative humidity of not greater than 85%.

CAUTION:

Whenever the MDT 60 is physically moved from a cold location to a warmer environment, be sure to allow sufficient time for the equipment temperature to equalize with the warmer location before activating the unit. Condensation developed by the temperature differential could possibly impair the MDT 60.

A standard three-pronged 115-volt (230-volt) ac power outlet should be close by. Voltage selection is discussed in the following paragraph.

SET-UP PROCEDURE

Line Voltage Selection

Once you have selected your work area, verify that the voltage switch on the rear panel is properly set for the installation site power source.

The MDT 60 line voltage can be set for either 115-volt or 230-volt AC operation. Units shipped to customers in the United States are set for 115-volt operation, but may be switched to 230-volt operation by changing the line voltage switch at the rear of the MDT 60 (see Figure 2-1).
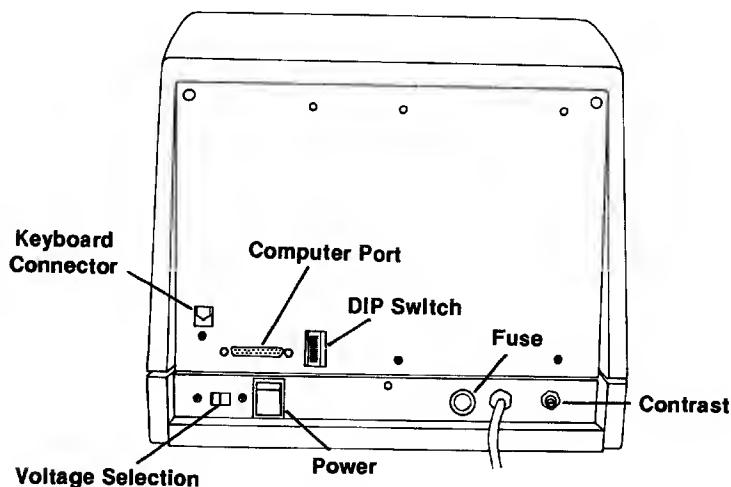
Figure 2-1: MDT 60 Rear Panel

SETTING THE CONFIGURATION SWITCH

The 8-position DIP switch located on the rear panel is used to set the terminal baud rate, parity, character set, and function key sequence type. Refer to Figure 2-1 for the location of the switch (SW1) and then set the switches (paddles on the switch) to match your computer's requirements. Switches 1 and 2 affect baud rate, 3 and 4 set parity, 5, 6 and 7 select the character set and Switch 8 is used to select the key sequence sent to the computer when a function key is pressed.

Figure 2-2 shows this switch as set at the factory, and Table 2-1 lists the available switch settings.
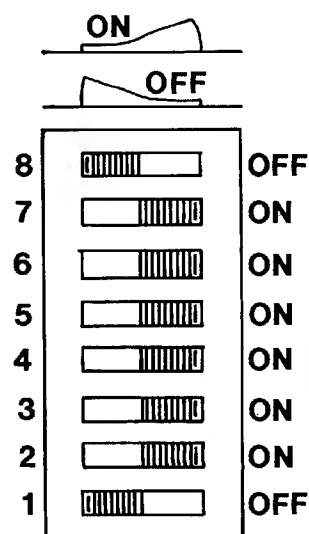
Figure 2-2: Default Switch Settings

Table 2-1: AVAILABLE CONFIGURATION SWITCH SETTINGS

BAUD RATE	PADDLE 1	PADDLE 2
19200	ON	ON
9600*	OFF	ON
1200	ON	OFF
300	OFF	OFF

PARITY	PADDLE 3	
ENABLED	OFF	
DISABLED*	ON	

PARITY SELECT	PADDLE 3	PADDLE 4
ODD	OFF	ON
EVEN	OFF	OFF
MARK*	ON	ON
SPACE	ON	OFF

CHARACTER SET	PADDLE 5	PADDLE 6	PADDLE 7
U.S.*	ON	ON	ON
U.K.	OFF	ON	ON
FRENCH	ON	OFF	ON
GERMAN	OFF	OFF	ON
SPANISH	ON	ON	OFF
DANISH/NORWEGIAN	OFF	ON	OFF
SWEDISH/FINNISH	ON	OFF	OFF
ITALIAN	OFF	OFF	OFF

FUNCTION KEY SEQUENCE TYPE	PADDLE 8
MORROW MODE* (starts with ASCII FS, followed by a character, no terminator)	OFF
TELEVIDEO MODE (starts w/ASCII SOH, followed by a character, CR terminator)	ON

*Indicates default factory setting

CONNECTING THE MDT 60

The MDT 60 may be cabled directly to a local computer, or it may be connected to a modem for communication via telephone data lines to a remote computer.

RS-232C Interface (J1)

The Computer Port interface (J1) provides RS-232C signals and levels as specified in the RS-232 standard. One end of an RS-232C cable should be connected to this port. The other end should be connected to the required serial port on your computer or modem. The maximum permissible cable length is 50 feet for RS-232C applications. Morrow provides a four-foot cable with each MDT 60.

Power Receptacle

Connect the power cord to the power receptacle on the rear panel. Plug the pronged end of the power cord into a grounded outlet, and verify that the line voltage is properly set (see Line Voltage Selection).

SECTION 3: OPERATION

INTRODUCTION

This section provides the information necessary for the operator
to utilize the MDT 60 to its fullest capabilities.   This section
emphasizes the commands required to initiate and control various
terminal operations, whether originating from the Morrow Designs
computer or the keyboard.

TURNING POWER ON

1. The MDT 60 power switch is located on the rear panel (refer
    to Figure 2-1).   Make sure the unit is plugged in, line
    voltage is properly set, and turn the switch to the ON
    position.

2. Wait approximately 20 seconds for the unit to warm up.   The
    cursor should appear in the HOME position (upper left corner)
    and the terminal will sound the audible alarm.

    If the cursor does not appear, turn off the MDT 60, wait
    15 seconds and apply power again.   If the cursor still
    does not appear, check that the CONTRAST control is
    turned up (see Contrast Control below), and then contact
    your dealer.

Contrast Control

The contrast of characters and screen background may be adjusted
by turning the CONTRAST control knob on the rear panel of the
terminal (see Figure 2-1). If you turn on power to the MDT 60,
and the cursor does not appear, turn this knob clockwise until
the contrast of cursor to screen background is sharp enough to
comfortably view the display.

Screen Saver

The MDT 60 offers a Screen Saver function, which is enabled when
the terminal is shipped from the factory. If the keyboard is not
accessed for 15 minutes, or data has not been received from the
computer in this period of time, the screen will automatically go
blank.   This prolongs the life of the phosphor on the screen,
and helps eliminate damage to the screen when the terminal is to
remain ON but unchanged for extended periods of time.   Once data
is received by the computer, or any key is pressed on the key-
board, the screen will appear normally.   Data previously dis-
played, before the screen went blank, is not lost as long as the
terminal is not powered off.

To disable the Screen Saver feature, enter:

ESC @ 1

Once disabled, enter the following command to enable this feature:

ESC @ 0

TURNING POWER OFF

Turn off the MDT 60 by setting the ON/OFF switch to OFF.

OPERATING MODES

The MDT 60 operates in the On-Line Conversation Mode. Data entered from the keyboard is immediately transmitted to the computer, character-by-character. All ASCII characters are sent directly. This includes the normal ASCII characters (` ` to DEL, i.e. 20h to 7fh) and control characters. For all other characters, a two or three character sequence is transmitted to the computer. The character sequence sent starts either with

1) the ASCII character SOH (01h or ^A), followed by a function code, and terminated by a carriage return (ASCII 0dh, ^M), or

2) 1ch, followed by a function code, with no carriage return.

The function codes sent are listed in Table 3-2; keys send out different codes depending on whether or not the SHIFT or CTRL key is pressed. Displayed data is echoed from the computer.

Normal Mode

Normal Mode causes the 96-displayable ASCII characters (20-7F Hex) to be displayed when received. The 32 control codes (00-1F hex) are acted upon only if they are control codes for the MDT 60; otherwise they are ignored.

Monitor Mode

Setting Monitor Mode causes the terminal to display all 32 control codes (00-1F hex) instead of acting upon them. This is particularly useful as a diagnostic aid.

KEYBOARD OPERATION

The operator uses a keyboard very similar to that of a standard office typewriter to enter data and perform control operations. Functionally the keyboard consists of the displayable 96-ASCII character set keys and various control, function and modifier keys. All keys will repeat automatically if held down for approximately one-half second or more. The keyboard is made up of the following classes of keys:

. Alphanumeric and Punctuation Keys

. Numeric Keypad

. Modifier Keys

. Cursor Control Keys

. Function Keys

. Special Operation Keys
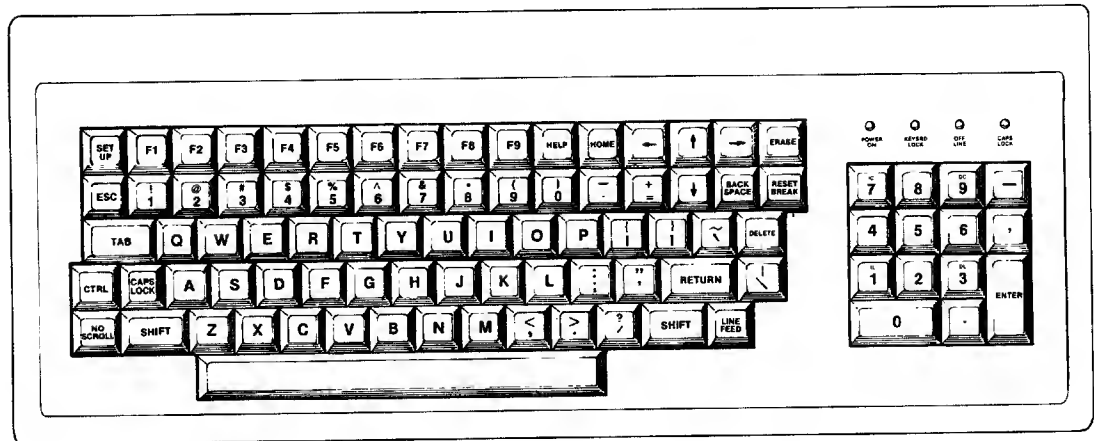
Figure 3-1: MDT 60 Keyboard

Alphanumeric and Punctuation Keys

The upper/lower case, numerics, and punctuation characters from
the 96-displayable ASCII character set, (21-7E Hex) including
SPACE (20 Hex) and DEL (7F Hex), are output to the display and
transmitted to the computer when a key is pressed. Keys that
have a double legend produce the lower-case or lower legend
unshifted, and the upper-case or upper legend when pressed with
the SHIFT key. The SPACE key generates an ASCII 20 Hex code for
transmission and occupies a space on the display.
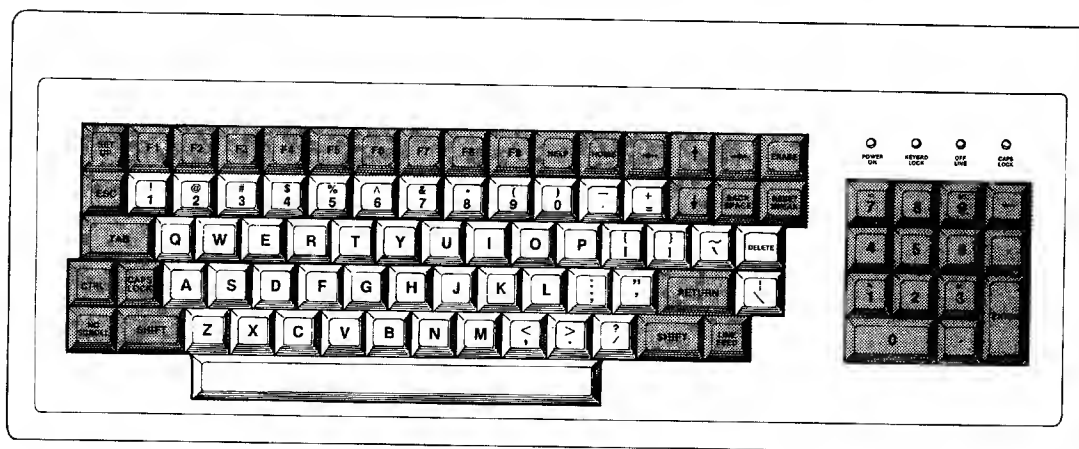
Figure 3-2: Alphanumeric and Punctuation Keys

Numeric Keypad

The ASCII numerals 0 through 9 along with minus, comma, and
period, are output to the display and transmitted to the computer
when a key is pressed. The ASCII hex codes generated are identi-
cal to the lower legend numerals and punctuation on the main
keyboard area.
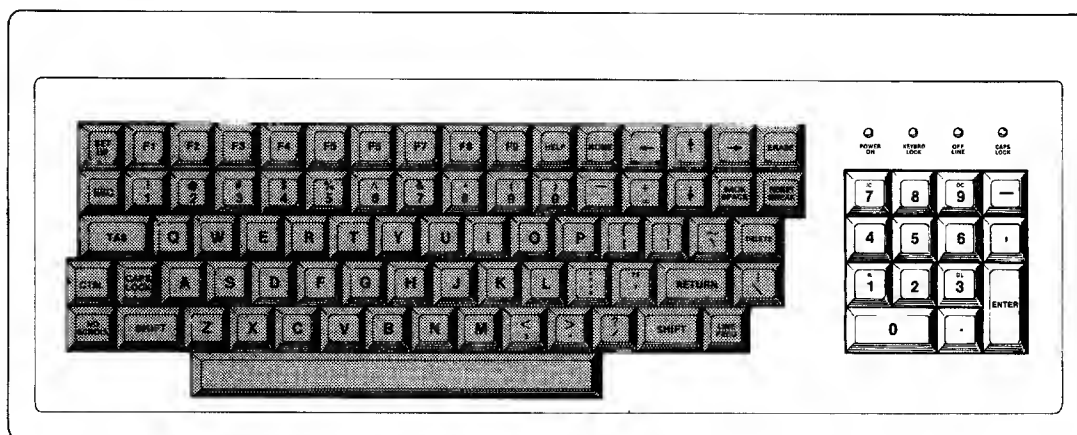
Figure 3-3: Numeric Keypad

The numeric keypad can also serve as a function keypad, by en-
abling the "Keypad Applications Mode". Table 3-1 lists the codes
sent from the numeric keypad when the terminal is in Keyboard
Applications Mode.

Table 3-1: Numeric Keypad (Applications Mode)

KEY	UNSHIFTED CODE	SHIFTED CODE	CONTROL CODE
0	30h	20h	10h
1	31h	21h	11h
2	32h	22h	12h
3	33h	23h	13h
4	34h	24h	14h
5	35h	25h	15h
6	36h	26h	16h
7	37h	27h	17h
8	38h	28h	18h
9	39h	29h	19h
Decimal point	2Ah	2Bh	2Ch
Enter	2Dh	2Eh	2Fh
Dash	3Ah	3Bh	3Ch
Comma	3Dh	3Eh	3Fh

To enter this mode, enter the sequence:

ESC [

To clear Keypad Applications Mode, enter:

ESC]

Modifier Keys

The following keys do not generate any output by themselves, but
modify the code generated by the alphanumeric keys on the key-
board.
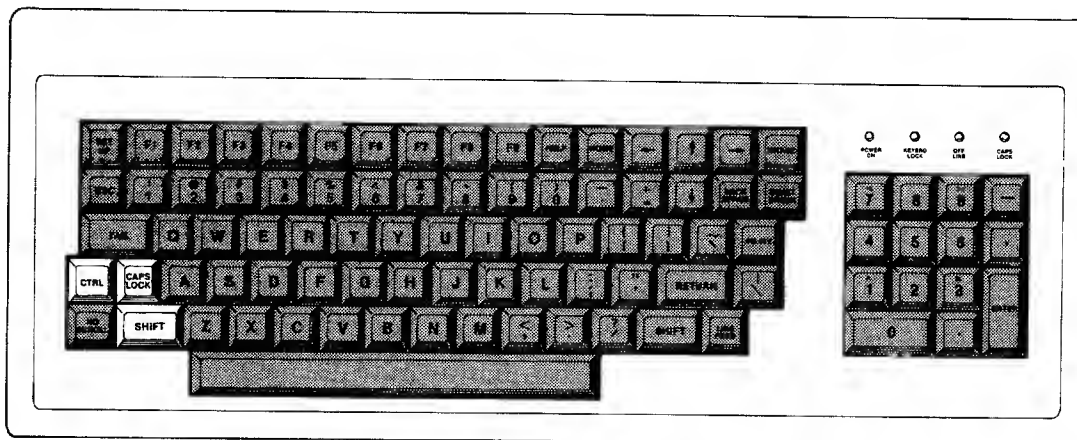
Figure 3-4: Modifier Keys

SHIFT causes the upper legend character of a double legend key
to be produced when pressed in conjunction with either SHIFT key.
The 26-alpha characters are shifted for upper-case, and unshifted
for lower-case.

CAPS LOCK this push-on/push-off key causes the 26-alphanumeric
characters to stay shifted (upper-case) when on. The numeric and
punctuation keys, as well as the various control keys, are not
affected.

CTRL causes one of the 32-ASCII control codes to be generated
when pressed in conjunction with an otherwise displayable charac-
ter key.   The character generated will not occupy a space on the
display.   The control codes utilized by the MDT 60 are detailed
in Table 3-3. CTRL also changes the code sent by function keys.

Cursor Control Keys

The Cursor is used to indicate the next character position to be entered on the display. The following keys are used to position the cursor on the display:
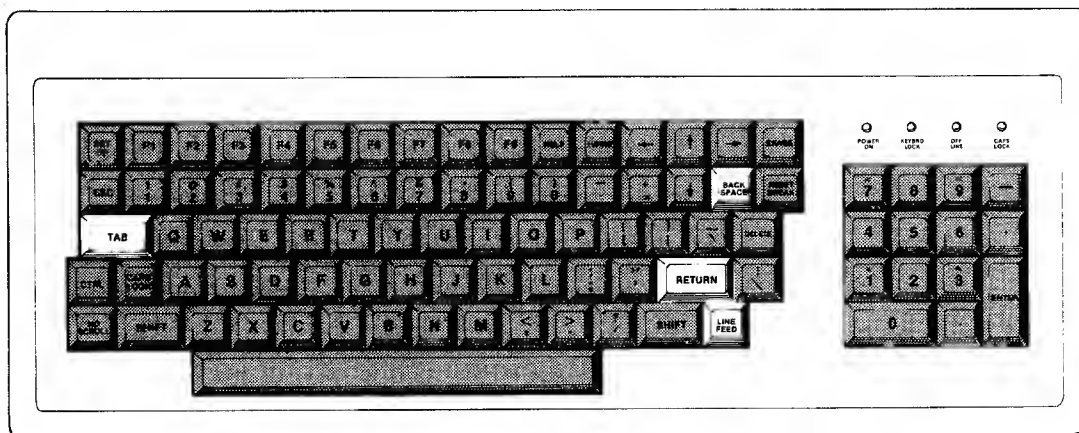
Figure 3-5: Cursor Control Keys

TAB will cause the cursor to advance to the next tab stop and an HT (09 Hex) code to be generated. Tab stops are automatically set at every eight character positions, 0, 8, 16,...72. TAB, when pressed with SHIFT or CTRL, also serves as a function key.

BACKSPACE causes the cursor to move one character position to the left, or to the end of the previous line if the cursor was at the beginning of a line.   A BS code (08 Hex) is generated when the key is pressed.

RETURN moves the cursor to the beginning of the line it was in, or the beginning of the next line (carriage return plus line feed) depending upon the program being run.

LINE FEED moves the cursor to the same column position of the next line down.   This will cause a scroll operation to occur if the cursor was on the bottom line of the display. The Line Feed key produces an LF (0A Hex) code when pressed.

Function Keys

The nine function keys, F1 thru F9, and seven other special keys transmit a single control character. The keys perform no local operation and are used as special commands to be interpreted by the computer for particular system operations. These MDT 60 function keys are illustrated in Figure 3-6; the control sequence transmitted by each key is listed in Table 3-2.
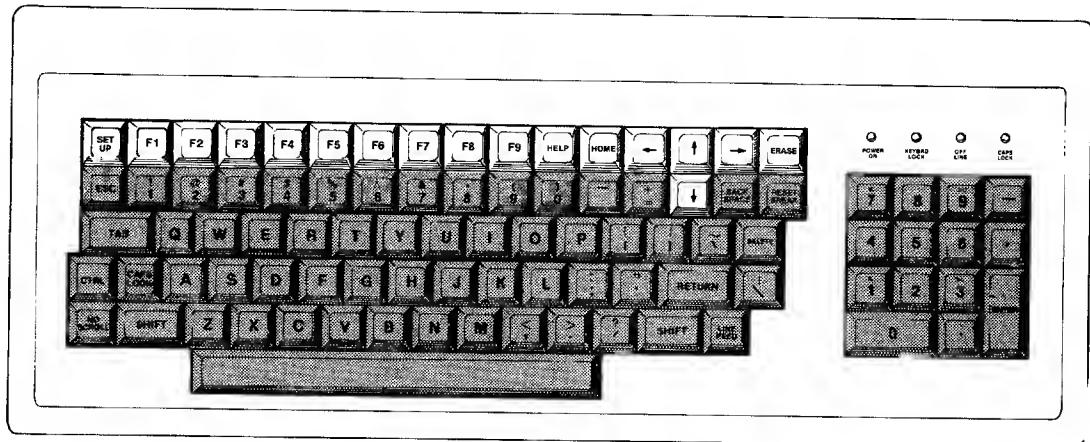
Figure 3-6: MDT 60 Function Keys

Table 3-2: Function Key Codes

KEY CODE	UNSHIFTED CODE	SHIFTED CODE	CONTROL
F1	40h	60h	0h
F2	41h	61h	1h
F3	42h	62h	2h
F4	43h	63h	3h
F5	44h	64h	4h
F6	45h	65h	5h
F7	46h	66h	6h
F8	47h	67h	7h
F9	48h	68h	8h
ERASE	49h	69h	9h
↑	4Ah	6Ah	Ah
↓	4Bh	6Bh	Bh
←	4Ch	6Ch	Ch
→	4Dh	6Dh	Dh
HOME	4Eh	6Eh	Eh
HELP	4Fh	6Fh	Fh
SET-UP	O	O	O

Special Operation Keys

The keys listed below perform special operations or have a unique effect on the MDT 60.
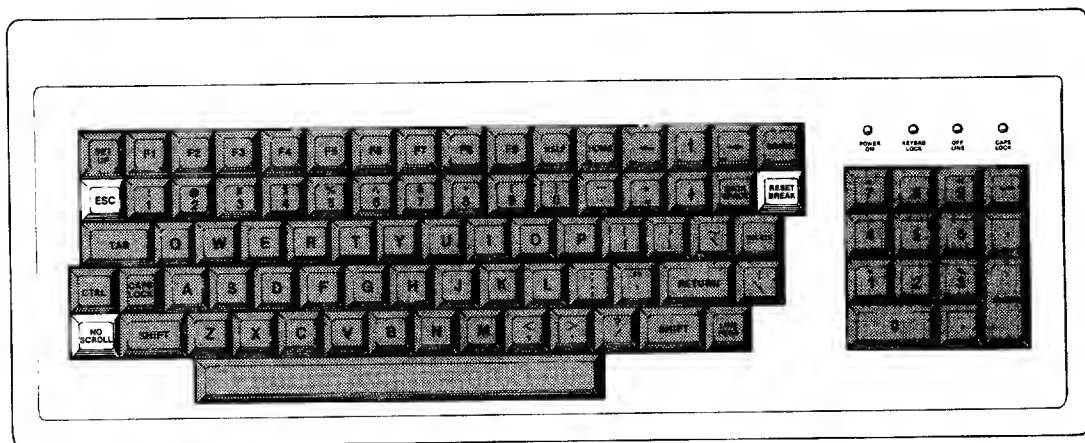
Figure 3-7:   Special Operation Keys

BREAK causes a ^C (control C) to be sent.

ESC generates a special control code (1B Hex), usually followed by one or more characters, used for command operations.   Thus, ESCape is usually considered as a "Lead-In" character for terminal control operation.   "Control Codes and Escape Sequences" and Table 3-4 detail the ESCape sequences utilized by the MDT 60.

NO SCROLL generates a ^S (control S) when pressed.

CONTROL CODES AND ESCAPE SEQUENCES

Control Codes

The operational characteristics of the MDT 60 are controlled, in part, by a group of control codes which may originate at the computer or at the keyboard. Control codes are not displayed. Of the 32-ASCII standard control codes available for use, the MDT 60 utilizes the 12 control codes listed in Table 3-3.

Escape Sequences

An ESCape sequence is formed by executing the ESC ASCII control code, followed by one or more otherwise displayable ASCII characters. Each ESCape sequence controls a specific terminal operation. Some operations are one-time only, others remain operative for as long as power to the unit is not interrupted or until terminated by a control code or ESCape sequence.

Table 3-3: Control Codes Utilized by the MDT 60
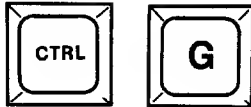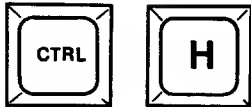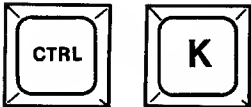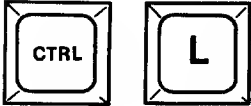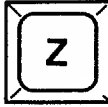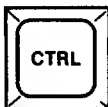
CODE	OPERATION	DESCRIPTION
CTRL G	Bell	Sounds the audible alarm. (If margin bell enabled in set-up.)
CTRL H	Cursor Left (Backspace)	Moves the cursor to the left one character position. The cursor moves to the last position of the previous line when at the first character position of the line.
CTRL I	Tab	Moves the cursor to the next tab stop, every eighth character position (modulo 8 column tabs).
CTRL J	Cursor Down (Line Feed)	Moves the cursor to the next line down in the same column. If the cursor is located on the last line, a scroll operation will be performed, if enabled.
CTRL K	Cursor Up	Moves the cursor to the previous line up in the same column. If the cursor is located on the first line, no operation takes place.
CTRL L	Cursor Right	Moves the cursor to the right one character position. The cursor moves to the first position of the next line, when at the last character position of a line.

Table 3-3 (Continued)
Control Codes Utilized by the MDT 60

CODE	OPERATION	DESCRIPTION
[CTRL] [M]	Carriage Return	Moves the cursor to the first character position of the current line.
[CTRL] [N]	Unlock Keyboard	Overrides the Lock Keyboard function. Keys pressed generate output to the computer.
[CTRL] [O]	Lock Keyboard	Disables code generation from the keyboard.
[CTRL] [Z]	Clear Screen & Home Cursor	Erases the display to spaces, and moves the cursor to the Home position.
[CTRL] [^]	Home Cursor	Moves the cursor to the first character position of the first line of the display.
[CTRL] [—]	Carriage Return & Line Feed	Moves the cursor to the first character position of the following line.

NOTE:

The CTRL key must be held down while pressing the associated key in the control code sequence.

Table 3-4: MDT 60 Escape Sequences
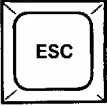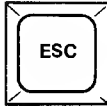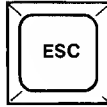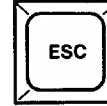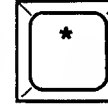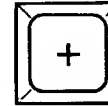
ESCAPE SEQUENCE	COMMAND	DESCRIPTION
[ESC] [!] n	Print Alternate (Graphics) Character	Causes the following character "n" to be printed from the alternate character set.
[ESC] [@] 0	Set Screen Saver	Display goes blank if keyboard is not accessed or data is not received by the computer after a 15 minute time period.
[ESC] [@] 1	Disable Screen Saver	Display is constant, while power is on.
[ESC] [#]	Display Version	Displays the current version number of the monitor software.
[ESC] [$]	Set Graphics Mode	The characters @, A...~ and DEL (40h through 7Fh) are replaced with graphics characters in this mode.
[ESC] [%]	Clear Graphics Mode	Turns the Graphics Mode off.
[ESC] [*] or [ESC] [+]	Clear All To Spaces	Causes all display data to be cleared to spaces.

Table 3-4 (Continued)
MDT 60 Escape Sequences
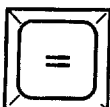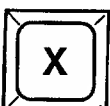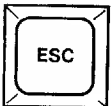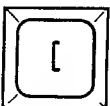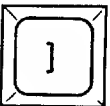
ESCAPE SEQUENCE	COMMAND	DESCRIPTION
[ESC] [( ]	Set Bright	Causes DIM to be terminated.
[ESC] [ )]	Set Dim	Causes all subsequent data to be entered as DIM.
[ESC] [0]	Alignment Check	Fills the screen with the character "H" for alignment checking.
[ESC] [=] [Y] , [X]	Address Cursor	Used to position the cursor to a specified row (Y) and column (X) on the display. The location is expressed as two ASCII characters. The second specifies the column coordinate (20-6F Hex). The first specifies the row (20-37 Hex).
[ESC] [[ ]	Set Keypad Applications Mode	Changes the numeric keypad to a function keypad (see Table 3-1).
[ESC] [ ]]	Clear Keypad Applications Mode	Restores function of numeric keypad to normal operation (numerics, minus, comma and period).

Table 3-4 (Continued)
MDT 60 Escape Sequences

ESCAPE SEQUENCE	COMMAND	DESCRIPTION
[ESC] ["] n	Set Cursor Type	Specifies type of cursor displayed, as "n" equals: 0-block,slow blink 1-block,fast blink 2-block,no blink 3-underline, slow blink 4-underline, fast blink 5-underline, no blink 6-no cursor 7-leave cursor as it is
[ESC] [?]	Read Cursor	Causes the terminal to transmit the cursor row and column position in the same format as described in "Address Cursor" Command. Row position is transmitted first, followed by the column position.
[ESC] [E]	Insert Line	Causes a line of spaces to be inserted at the line containing the cursor. All lower lines scroll down one line, the bottom line being lost.

Table 3-4 (Continued)
MDT 60 Escape Sequences
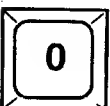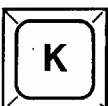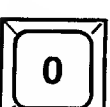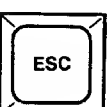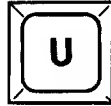
ESCAPE SEQUENCE	COMMAND	DESCRIPTION
[ESC] [G] n	Set Attribute	where "n" is: 0 Normal 1 Underline (UL) 2 Dim 3 UL and Dim 4 Reverse (RV) 5 RV and UL 6 RV and Dim 7 RV, Dim and UL
[ESC] [I]	Back Tab	Cursor is positioned to the preceding tab stop.
[ESC] [J] [0] , [1]	Keyclick On/Off	0=keyclick off. 1=keyclick on.
[ESC] [K] [0] , [1]	Inverse Screen	0=Green characters on black screen. 1=Black characters on green screen.
[ESC] [Q]	Insert Character	Moves all data from the cursor position to the end of the line one position to the right. A space is written at the cursor position.

Table 3-4 (Continued)
MDT 60 Escape Sequences

ESCAPE SEQUENCE	COMMAND	DESCRIPTION
ESC R	Delete Line	Erases the line containing the cursor and moves all lower lines upward one line.
ESC T	Erase to End-of-Line	Erases all data from the cursor position up to the end of the line.
ESC U	Set Monitor Mode	Terminal displays all 32 control codes, but does not act on them.
ESC W	Delete Character	Deletes the character under the cursor and moves all characters from the cursor to the end of the line.
ESC X	Clear Monitor	Same as Normal Mode Mode. The 96 displayable ASCII character are displayed when received. The control codes recognized by the MDT 60 are acted upon.
ESC Y	Erase to End-of-Page	Erases all data from the cursor position up to the end of the display.

DATA TRANSMISSION

Data entered from the keyboard is immediately transmitted to your computer character-by-character. This includes those control codes or ESCape sequences which are normally not displayed, but are echoed by the computer. Transmission is serial asynchronous, with an ASCII character format of 1 start bit, 8 data bits, odd/even, or no parity bit and 2 stop bits. The word structure and baud rate used are selectable via the rear panel DIP switch. Computer Port communication is via a bidirectional RS-232C interface as detailed in Section 2.

Data communications takes place whenever the MDT 60 is connected to your computer. When receiving data, the MDT 60 has an X-ON/X-OFF busy indication feature used to command the computer to suspend transmission to prevent data loss.

CURSOR CONTROL

Relative Cursor Positioning

The cursor may be moved to any position on the screen using the separate cursor control keys. Its position signifies the next character position in the display. When data is being entered, the cursor moves one position to the right on the line or to the first position in the next line each time a character is written. The control codes required to control the cursor position are outlined in Table 3-3.

Absolute Cursor Positioning

Absolute Cursor Addressing requires commanding the cursor to a specific display location. Commanding the cursor to a specific location (loading the cursor) is normally executed by the computer. The Load command is executed by means of an ESCape sequence in which the row and column location of the cursor is expressed as a pair of ASCII characters.

Load Cursor Operation

When the Load Cursor operation is initiated the cursor moves to the commanded position. Enter the sequence:

ESC=RC

Where "R" is an ASCII character associated with the row (1-24) or the decimal value of the row plus 32; "C" is the ASCII Character associated with cursor column (1-80) position or decimal value of the column plus 32. To determine ASCII character values, see Table 1-1.

EXAMPLE: ESC=1/ commands the cursor to Row 18, Column 16. (ASCII)

Scrolling

In the MDT 60 data is entered into display memory starting at the HOME position (upper left corner), and continues through Position 80 of Line 24, (last data position). When Position 80 is filled, or when a New Line or Line Feed occurs in Line 24, the display is shifted upwards one line and data entry continues in Position 1 of the new Line 24. The original top line of the display is lost. Scrolling continues indefinitely.

DISPLAY FORMATTING OPERATIONS

The MDT 60 has various attributes and fields used to highlight data on the display. The visual and field attributes used for display formatting are discussed in the following paragraphs.

Visual Attributes

There are three Visual Attributes that can be assigned to any character on display. They include: Underline, Reversed, and Reduced Intensity. The Attribute that will be used is assigned singularly. Once assigned, all subsequent data entered will appear with the selected attribute. If Protect Mode is not set, the data is not treated uniquely; it may be overwritten and erased or cleared by all associated commands.

To set visual attributes, enter the command:

ESC G n

The value of "n" selects the desired attribute as follows:

0	Normal
1	Underline
2	Half Intensity
3	Underline and Half Intensity
4	Reverse
5	Reverse and Underline
6	Reverse and Half Intensity
7	Reverse, Half Intensity and Underline

SECTION 4: CARE OF THE MDT 60

Proper care of the MDT 60 consists of performing the routine cleaning
and inspection procedures listed in the following paragraphs.

Cleaning

At periodic intervals, clean the exterior housing and lightly dust the
unit using a soft brush or damp lint-free cloth.   Paper towels may be
substituted if desired.   Do not use petroleum base cleaners, such as
lighter fluid, as this could be harmful to the painted surface. Remove
smudges from the CRT exterior screen and the housing with conventional
glass cleaners or alcohol. Be careful not to scratch the CRT screen.

Inspection

Periodically inspect the keyboard assembly and switches for freedom of
movement.   Determine that the intensity of characters displayed on the
CRT screen have not diminished. Any required mechanical and electrical
adjustment shall only be performed by our factory authorized
maintenance personnel.

SECTION 5: TROUBLESHOOTING THE MDT 60

If you encounter operational problems with the MDT 60, you should perform the Power-On Reset procedure discussed in Section 3. When the MDT 60 is reset, the terminal Self-Test will be executed. Self-Test will verify the integrity of the display memory, the program memory, and the associated internal control logic. Upon completion of Self-Test, the terminal will sound the audible alarm and the cursor will appear in the upper left corner of the screen.
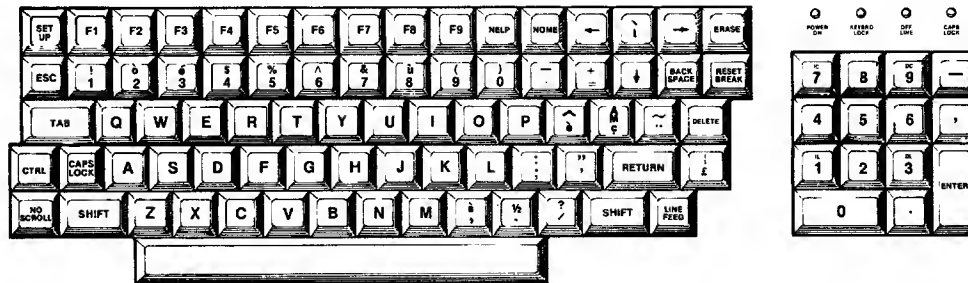
If the self-test function does not indicate any problems or terminal failures, please refer to Table 5-1 for possible solutions to problems arising from improper switch settings, static electricity, etc.

Table 5-1: Troubleshooting Guide

| PROBLEM	PROBABLE CAUSE	SOLUTION
"Dead" terminal	No AC power	Plug power cord in. Turn power switch on. Check setting of line voltage switch.
No cursor	Light contrast setting, or cursor display disabled by software.	Adjust contrast control switch.
Computer does not respond to input	Configuration switch settings are incorrect	Refer to Section 3.
Terminal displays "garbage" characters	Configuration switch settings are incorrect	Refer to Section 3.
	Static electricity	Spray carpeting with antistatic spray, or install antistatic floor mat.
	Cable and power cords are wrapped together	Separate cables to eliminate noise.

Italian

French

German
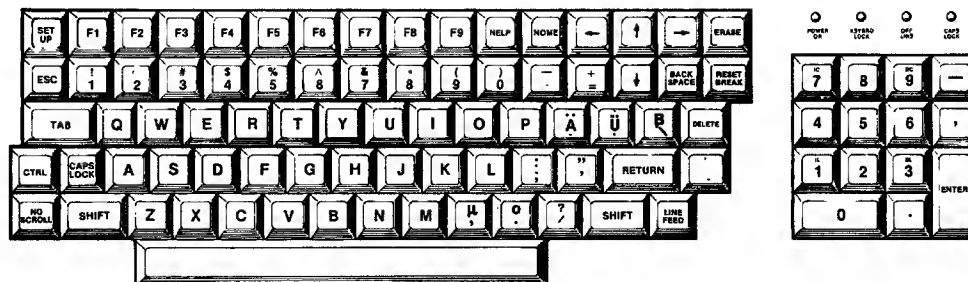
APPENDIX: FOREIGN CHARACTER SETS (KEYBOARD LAYOUTS)

Swedish/Finnish
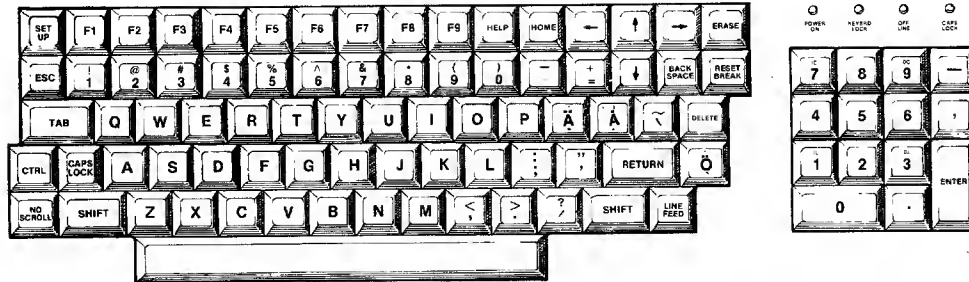
Danish/Norwegian
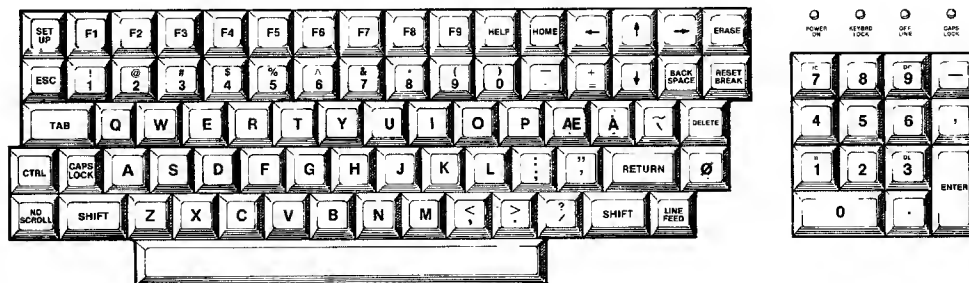
Spanish

SUBJECT INDEX

A
Absolute Cursor Positioning, 3-18
Alphanumeric and Punctuation Keys, 3-3, 3-4
Applications, 1-1
Applications Mode, 3-5

B
Baud Rate, 2-3, 2-4

C
Cable Length, 2-5
Character Format, 1-4
Character Set, 2-3, 2-4
Cleaning, 4-1
Computer Port, 1-6, 2-5
Configuration Switch, 2-3, 2-4
Contrast Control, 3-1
Control Codes, 3-6, 3-10, 3-11
Control Logic, 1-2, 1-6
Cursor Control Keys, 3-7

D
Data Communications, 3-14
Display Character Format, 1-9
Display RAM, 1-3

E
Escape Sequences, 3-8, 3-9, 3-10, 3-13

F
Function Keys, 3-8
Function Key Sequence Type, 2-3, 2-4

G
General Features, 3-1

I
Inspection, 2-1, 4-1
Interface Logic, 1-6

MORROW